Table of Contents

Paraplegia:
A. From increased vacuolization of the cord
B. From diminished amount of blood
   1. White Softening  2. Reflex Paraplegia
C. From other unrecognized causes
   1. Pressure of tumors atrophied vertebrae 2. Concussion
   3. Hysterical  4. Loci  5. Pressure on nerves

Means of diagnosing the locality of lesion

Therapy

Treatment

John Duncan
Paraplegia is a disease which seems to have been regarded by the ancients rather as a particular manifestation of paralysis from apoplexy than as arising from causes peculiar to itself. Hippocrates talks of apoplexy of the leg, and mentions paraplegia, using the word in this sense, as epidemic in Phœnis during a winter. It is indeed difficult from the variety of meanings to understand their doctrines on the subject. From the derivation it was, doubtless, originally synonymous with hemiplegia, which has always been used so now; but this was speedily changed. Pseudo-Aetius states that Apoplexy, Paraplegia, Paralysis (and) Paralysis.
Paralysis are all generally the same, and proceeds to define the first as a loss of sense and motion in the whole body, paraplegia as a part, and paralysis as a remission in the power of motion only. In this sense it seems to have been often used; it has now, however, come to be applied to that form of paralysis which affects only the lower part of the body, generally but not always accompanied by anæsthesia.

Paraplegia is to be regarded as a symptom of some change in the Spinal Cord or its envelopes; for, although loss of power in the legs may be the first symptom remarked in general paralysis of the insane, on closer inquiry it will be found that in that disease some mental defect is present and the motions of the tongue deficient in precision or strength. We shall accordingly divide our subject into 1. the Lesions of the Cord producing paraplegia which are characterized by increased Vascularity. Secondly, 2. those in which the amount of blood is diminished, while in a 3. class we may arrange several other Causes not reducible to the above. It
will be found that between the first and second
in typical forms there exists a well marked
distinction in symptoms and treatment, while the
diagnosis of the third is often extremely difficult.

There are two classes of symptoms
common to all lesions of the Cord, one the result
of diminished motor power, the other of impaired
d sensation. From the aesthetic change results that
peculiar feeling of elasticity between the sole of
the foot and the ground which is so often des-
cribed by patients, and which seems to convey the
impression that undue rubber, codd, or something
soft and compressible intervenes. It gives rise
also in part to the difficulty in maintaining
equilibrium, to the straddling gait, and the forcible
stroke of the heel upon the ground in walking.
The slow swung motion, which is to be observed
in every one when standing upright without support
is immediately increased in the Paraplegic;
and as might be expected it seems easier to
be steady during progression than when stand-
ing still. In this manner a patient may be
walking fast and tolerably well, keeping, of
course, the feet for apart, when if suddenly
stopped he will swing and totter for some
while.
time to apparently a most dangerous extent. This unstable equilibrium is greater in the dark or with the eyes shut, and, although even on the clearest it requires a stronger effort of the will to remain steady without than with the assistance of sight, in the far advanced paraplegia it is utterly impossible. He uses sight in fact more than either touch or the muscular sense, and keeps his eyes fixed on his feet or some object that may assure him he is perfectly erect, and when the disease has proceeded farther he is even unable to sit with them closed. This hypochondriasis states is pathognomonic of Tuberc Dorsalis which with some means disease of the Spinal Cord as a transmitter of impressions, as of motion and sensation, but in this he is not altogether correct, as it depends on the anaesthesia which though very often is not always present. Two Cases of hemiplegia have, moreover, been mentioned to me in which the patients were quite unable to stand in the dark. I had not an opportunity of seeing these cases; but, as they were described, the patients stood well on both feet until the gas was put out or the eyes closed when they
Brown Segunda Central Nervous System p. 129. Note...

See also on this subject case by Dr. C. Bell. New Sept 21st.
they suddenly staggered and sometimes fell. This may have arisen in two ways. It may be that there was loss of muscular sensibility, for then depends the symptom we are discussing, or it may be that the patient, suddenly deprived of the support of one leg when standing upon both, naturally, as would happen with all staggered to the side. Rambourc's assertion is again proved to be somewhat loose from the fact that paraplegia may occur, though it rarely does so, without the required anaesthesia and consequent impaired equilibrium, etc. I would merely refer to a case related by Mr. Brown himself in which the patient, deprived of cutaneous sensibility but retaining the muscular sense, was able to walk perfectly without looking at the feet. It is unnecessary to enter into further proofs that this depends on the muscular sense; it is sufficiently proved by this case and another interesting one of Dr. Bell's to which I would refer. There are various other symptoms arising from anaesthesia. A want of precision in all locomotion, an impossibility of stooping to pick things up, extreme difficulty in turning, all arising from a want of
(1) De la lettre Spinoza I p.294.
(2) Compte rendu System p.1267.
means of directing the muscular power. The
various kinds of anaesthesia usually go together
but by several cases it is proved that touch,
feeling of hot and cold, muscular sense, sense
of tickling may be lost individually. Such
cases are recorded by Olivari,[11] and by Sevareid[21]
who gives a considerable list; but we shall probably
revert to this in speaking of the mode of determi-
ning the locality of spinal lesions.

As particular symptoms need
be recounted under the head of loss of voli-tilal
power. Force in all motions is wanting, and
this may proceed to the extent of complete in-
imobility, and of course aids in producing
many of those phenomena which are due
principally to anaesthesia. For it is necessary
to refer more particularly to the somato-
and reflex systems as these depend more
on the site than the character of the disease.
Such are the phenomena that may arise
in any case of paralysis, and we shall
now consider those arising from increased
vascularity of the spinal cord. It is sufficient
generally to state that they consist of refined
sensations, pain along the spine with or
without
without pressure from without, and signs of irritation in motor nerves or some part of the reflex apparatus, such as twitchings, convulsions, cramps and spasms. Perhaps the most striking symptom of inflammatory disease is the sense of constriction at the upper limit of the paralysis. We shall discuss these more in detail under the various heads.

I. Inflammation of the Spinal Cord.

A. Meningitis.

This form of disease may assume either the acute or chronic shape. The latter, however, is extremely rare, and when it is present alone so closely resembles a chronic congestion of the meninges that it need hardly be considered apart. Cases of uncomplicated meningitis are rare.

Acute. The acute attack begins in various ways, with one person by a weakness of the legs, with another by numbness, with a third by constipation and retention of urine, as in the unexampled case of Gabriel Francis, who was four days in hospital before...
before anything farther appeared. It is rare for the legs to become at once paralyzed and
when paralysis does occur it is often due
more to the pain or motion than to an
absolute loss of power. The pressure on the
nerves as they issue from the spinal canal
is, indeed, the great cause of the paraplegia.
More frequently, however, than in any of these
ways the disease begins with pains in the
vertebral column, and as it progresses they
become very severe. Occurring in the lumbar
or lower dorsal regions, they are propagated
thence downwards to the paralyzed limbs, up-
wards along the spine. In the latter they
are greatly increased by motion, and, although
Olivier denies it as a rule, according to most
authors by pressure. Some spasm of the
long dorsal muscles is a frequent (and dis-
agreeable) occurrence; producing perfect opisthotonos
with irregular remissions and exacerbations.
The cause of this is not easy to discover.
It is probably not the irritation of motor
nerves traversing the meninges; for that is found
to give rise to Clinic Spasms and Convulsions
and perhaps the most likely view is that which
refers...
refers it to an impression on the sensory fibres acting reflexly through an irritated cord. Besides this tonic dorsal spasm, all kinds of clonic spasm in the paralysed parts are common in meningitis. The aesthetic changes are very various. Sometimes there is hyperesthesia, but, perhaps most frequently, the sensibility is neither increased nor diminished. Referred sensations, however, are constant, as tingling, prickling, formication, numbness, and, if it can be reckoned as such, a sense of constriction, as well as intense neurogenic pains shooting through the limbs in all directions.

The usual inflammatory symptoms, fever, hard, quick, bounding pulse, hot skin, flushed face and hurried perspiration give further evidence of internal disease. The prognosis is very unfavourable. Creeping up the paralyses becomes general and complete, delirium may or may not come on, and between the 7th and 30th day the patient dies as coma. Our hope is that a lingering may be substituted for a rapid death, that the acute may pass into the chronic, of which the symptoms are to a certain extent the
Same, but milder and occupying an intermediate place between acute meningitis and congestion of the cord. The main difference is that in the chronic acute alterations in the patients condition take place from irregularly periodic attacks of congestion and effusion. The pain or pressure is not great, though motion intensely aggravates the suffering. We look forward hopefully to a more distant date for the almost inevitably fatal result. There is no recorded case of cancer on which absolute reliance can be placed; but it is to be remembered that the cord is not usually examined when a patient dies of a non-nervous disease.

The common signs of inflammatory destruction of substance are to be found in an after death examination. There is usually moreover an congestion of a yellow or greenish yellow colour, coagulable and fibrinous or purulent or tranquines-serous, which gravitates to the bottom of the canal where fluid and is generally most extensive at the posterior part of the cord. The pia mater is the membrane most affected, but the inflammation may be and often is often the result of injury.
injury, Caries, or tubercle of the vertebrae, propagated through the dura mater. The disease is common in conjunction with myelitis and there seems always to be some congestion of the Cord.

B. Myelitis. I Acute.

The acute myelitis is nearly always accompanied by meningeitis. It constantly indeed is true the case that before the time of Olivier the two were described under one name as rachialgytitis, spinitis &c. There are several recorded cases, however, in which the myelitis seems to have been uncomplicated, judging from the symptoms during life and the post mortem appearances; and the nature of these may perhaps be best illustrated by a reference to the case mentioned by D. Burrows and those related by Olivier. D. Burrows patient was attacked in convulsion from a common palsy in the evening of the 16th of a month and died on the 18th by gradual extension upwards of the paralysis. The paraplegia was complete, but sensation was seemingly impaired.
(2) Planaréa
not nearly to the same extent. There was no
pain on percussion of the spine, no involun-
tary action of the muscles, and indeed the
reflex motions seemed to be altogether destroyed
as the usual stimuli did not give the usual
result. The urine was normal, but dribbled
away and required to be drawn off. The bowels
were constipated. The negative statements are
to be viewed in reference to the fact that the
patient was comaee and increasingly so
from admissions till death; although on being
roused he gave cut, rational answers. The
pyrexia was very great. The autopsy showed
hemorrhage of the cords up to the highest
dorsal vertebra, and slight effusion in the
sheath. In the case of Anguina Mettal (2) the
symptoms in many respects the same differ
in the following. He had two previous attacks
probably of the reflex or convulsive character.
The third, fatal on the 12th day, accompanied
pneumonia. There were convulsive movements
of the limbs and some pain on touch or
motion, generating an idea to hyperesthesia
of all the sensitive nerves. There was laminar
softening with so great an indemnity of the
rest
(b) Oliver p. 419
rest of the Cord that it created on being cut.

The patient, Dubois in whom the autopsy showed complete solution of continuity at the 6th dorsal vertebra but in whom it must be added there was slight injection of the arachnoid had somewhat different symptoms in so far as the pain was very severe and was accompanied by cramps in the limbs, vomiting, icterus, and petechiae. The pyrexia was severe and the patient died on the 8th day.

The results to be obtained from a study of these cases are not very definite, but they give the foundations for diagnosis between myelitis and menigitis and certainly separate both from what we shall consider as not inflammatory lesions. It is interesting to remark that, while Allieuier (2) asserts that hyperesthesia is always due to illmenigitis, in the two cases we have quoted one, referred to as pure myelitis, suffered from increased sensitivity and the other in which there was some injection of the meninges had not, judging from the history, the slightest change in this respect.

2 Chronic. Chronic inflammation of

[Signature]
of the tissues of the Cord from its greater frequency and the longer time afforded for observation has been more accurately studied, and there is moreover, a very general agreement among writers on the subject, satisfactory as proving, if they did not copy each other, the correctness of their remarks.

The disease begins by weakness and a sensation of Cold in the limbs, with perhaps some vomiting, headache or other sign of gastric irritate derangement. Almost invariably there is a very unremotely pain in the spine more or less severe which is propagated both upwards and downwards. This goes on for some time and the disease progresses till, when the physician is sent for, the symptoms are much as follows. On present the patient one gentle the pain in the back is very severe, even when, as sometimes happens, it is slight, partial, or absent if undisturbed. I have myself seen one or two such.

Sensation may be seriously affected. Hyperesthesia is rare, as in general the grey matter is the seat of the lesion, so that if the white columns should tend to give rise
This case is apparently opposed to the statement of W.B. Seignor that unless the sore matter be free from disease there cannot be hyperesthesia.
In it, the destruction of conducting tissue in the centre of the cord is sufficient to mask it. But cases occur now and again in which sensibility is not diminished and I have met with three of excelled sensation. Two very marked ones are recorded in one of which the sector cadavers showed all but the posterior columns destroyed, while in the other, although there was no autopsy the symptoms of myelitis were clear. Usually, however, a loss of sensation is of early occurrence, and those phenomena, which we referred to diminution muscular sense, are extremely well marked. But in this respect there is the greatest difference in individual cases. Some walk with eyes fixed on the ground, others with head erect, and the latter, comparatively few in number, have generally little anaesthesia of any kind; yet it is to be observed, that the variegated enclosed sensation conductor are closely intermingled in the cord. Under the head of meningitis we referred to the sense of constriction at the upper limit of the paralyses. This is not always severe in myelitis, but it is rarely altogether absent.
On what it depends has not yet been clearly ascertained; but it probably arises from cramp of the abdominal muscles in those parts, which receive their nervous supply from congested and irritated roots issuing from the vertebral column just above the seat of the inflammation. Referred sensations are a most important symptom of neuralgia. They consist of formation, a feeling of the foot or leg being as it is called, asleep, pains in various parts of the paralyzed limbs, thighs, knees, ankles, or, as in one case I saw, in the calf of the leg. These pains may be, but are not always, due to the cramps to be specially mentioned, and the galvanic irritation of nerve end-organs consequent as has been proved on this and all other muscular contraction. The neuralgia may be present without the cramps and it occurs though there be little or no anaesthesia. Sensations of heat and cold are not so common; but when felt they bear no relation to the real temperature of the part, unless it be accepted as a fact, what probably is such, that the legs are generally found to be cold when they are felt to be hot by the patient.
Patient. Coldness of the parts is, in truth, usual and depends on a contraction of the blood vessels, due to cause. motor excitement. When complete disorganization of the lower end of the cord has taken place, there is increased heat (and) perhaps edema from paralysis of the vessels. The alteration rarely amounts to more than an abnormal liability to be affected by external changes in the temperature. It is sometimes accompanied by atrophy of the legs, which, however, from some cause or other seems more often to be a result of myelitis from fractured vertebrae than from most other forms of that lesion. In these cases it occasionally goes to an very distressing extent.

To conclude the sensory effects of myelitis there is an experiment, first pointed out by W. Brown-Severd, which is of some diagnostic value. The passage of warm or very cold substances from above downwards along the spine produces a normal feeling, till it is brought to the upper limit of the influence past whose burning pain is its effect. If this be true, and from all I can learn it is so, we have an important means not only of diagnosing
diagnosing myelitis but if assigning to it its
elocality in every case.

The degree in which motor power
is affected is very various, ranging from the
slightest difficulty in progression to complete
paraplegia, and this variety is due partly to
the extent of the spinal affection, partly to its
site. The paralysis is evenly distributed over all
the muscles.

The reflex apparatus is seriously in-
evolved in myelitis. Unless the lumbar b.ind be
affected, there are twitches, cramps, convulsions,
or spasms in the paralyzed limbs which may
be very slight especially in the early stages of
the disease, amounting only to an occasional
giving way of the knees or passive twitches
completely under the patient's control, when
his attention is directed to them. As the separa-
tion from the brain becomes more complete,
these also become more violent; jerking
contractions for many minutes at a time; and
what may originally have been classic pass
into tonic spasm of portions or groups of
muscles maintained for days or weeks.

These may arise from one of two causes.
Reflex power may be so excited by congestion of the ganglia or afferent filaments (and it generally is so in myelities above the lumbar enlargement) that the slightest stimulus, the moving of the bed clothes, a breath of air, or a change is sufficient to produce a discharge through the motor filaments. I have seen one case in a bad of an extremely nervous temperament, in which the slightest mental emotion was capable of giving rise to successive quivering of the palsey legs. But in myelities the reflex power may be entirely destroyed while the symptoms we have described yet exist; and we must then look for some other cause. And I think it will be found (2) in the congested and irritated state of the motor nerve fibres in the anterior portions of the cord or the anterior roots of the nerves: and the effect is similar in kind to the referred sensations produced by a like irritation of the sensory parts of the cord and of the posterior nerve-roots. It is difficult, perhaps, to account for the occasional character of the symptoms; but, if we take into account the varying degrees of stimulus and amount of blood in parts just beyond inflammatory disease.
poured, there are cases of seeming arrestment. Seven to nine years is not an uncommon duration and one case is recorded in which the paraplegia continued for 29 years. We anticipate (unless death be occasioned by intercurrent disease) a term sooner or later when by the gradual extension upwards of the paralyses, by the formation of bed sores and by malnutrition, the sufferer will be carried off exhausted, suffocated, or paralysed.

There are several post mortem appearances associated with myelitis. Perhaps the most common certainty is when it has been acute and then very often matter is also to be found, is pallor and increased of the cord in its red or yellow variety. Both of these have been distinctly shown to be inflammatory. On the other hand, certainly the most rare is atrophies of the cord. The only case I have been able to discover is one of Abercromby's in which, while hemiplegia was produced, all its symptoms were of the character already described. Hemiplegia from the nature of the lesion is more likely to be produced than a paralysis of both sides of the body.
disease, and the effects of motion position and other alterations on this morbid condition, we may form some idea of their Causation.

The muscles of the bladder and rectum almost invariably become affected and necessarily so as the Paralysis progresses. The involuntary muscles of these organs become, as a rule first paralyzed and this produces retention and constipation; but the sphincters very soon grow incompetent also, and, unless great care be taken, the patient's life becomes unbearable. In some cases, by far the least common, spasm of the sphincter vesicae with paralyses of the bladder continues till death. The conversion of serum into Carbonate of ammonia, so common in the inflammatory Spinal diseaces, is especially constant in myelitis, even when the other primary affections are not to be observed. According to many the change takes place in the bladder and there are two hypotheses advanced on this supposition. Some hold that the urine by long and frequent retention induces in its own decomposition so catarhal affection of the bladder which again reacts on its contents. Others
Others, who are probably correct (for we do not find this change in other cases of retention), maintain that the perspiration of the mucous membrane precedes the atrophy, and forms the ferment which produces it. In the same way the diseased mucous parts as a ferment in the prostatic diseases of old people. There are not wanting facts which would lead us to suppose that the decomposition of the urea takes place in the kidney, that it is secreted as Carbonate of ammonia. Experiments have been made by frequently passing the catheter; but, so long as we know nothing of the ferment, if there be such, and of its propensities of operation, they are comparatively unsatisfactory. It is a view suggested also by the facts already mentioned that the change is most frequent in myelitis.

As in meningitis the prognosis is very unpromising. The onset is almost certainly fatal in a few days and our only hope, purely realized, is that it may pass into the subacute form. In the chronic creeping myelitis the patient's life may be preserved for years, and, while it has never been
Undiagnosed suppuration is a not unusual appearance, which cannot be distinguished from those already mentioned, during the patient's lifetime. Exact in frequency to red softening is induration of the cord which, by many, is described as a separate disease. Oliver, however, while he does so, points out the great analogy that exists between induration and those lesions to which he confines the term 'myelitis'. It is impossible, indeed, in examining his cases to discover any material difference in symptoms. In more cases perhaps, there was hyperaesthesia; and he states himself, though it is hardly borne out by facts, that the paralysis is usually more complete. But even though this be true, it would simply prove that inflammation in the upper part of the spinal marrow is most likely to be followed by induration. In the case of the Marquis de Canceau quoted from Portal there was little but anaesthesia at first, although the paralysis afterwards became very complete. Prized symptoms of inflammation and congestion surrounded, in this case as in others, the indurated part even at the Pectoral Column.
Atrophy of the cord below the seat of disease is a frequent result of prolonged myelites and of all chronic paraplegia. There seems to be an increase in the spinal fluid proportioned to the amount of atrophy. Want of use is the probable explanation of this loss of substance which resembles closely the atrophy of old age.

C. Congestion of the Spinal Cord and its envelopes.

Congestion is of two kinds, active and passive; the former is the first stage of inflammation not necessarily severe that length, the latter is due to obstruction of the venous blood. Active congestion may or may not present a rapid plastic or serous effusion; the presence always throws out the watery parts of the blood. The difference is in fact the same as in other parts of the body. In symptoms we have no sufficiently diagnostic means to differentiate in individuals what slight differences there may be we shall point.
point out as we go on. Nor have we any very sure boundary line between congestion and inflammation, although a good guess may very generally be hazarded.

There are reported sensations, numbness alternating with tingling as characteristic. Brown Sequare has observed that the fingers and toes are the most frequent seats of these sensations; and one patient, whom I saw, while he admitted on questioning that he had pains in the thighs and elsewhere, said great stress on some pains under the nails of his great toes which had preceded and continued during his illness. There may be no sensations of this sort however, and Oliven gives several cases of obstructions con- gestion in which they did not exist. There may be pains in the spine similar to those of meningitis or myelitis; but more common by this is slight amounting only to uneasiness and little affected by motion, pressure or percussion. They are, as one might suppose, more severe in the active than the passive congestion. The constriction of the abdomen is usually to be observed. Hyperaesthesia
That this was not myelitis was shown by his gradual improvement up to the time he was last seen. As meningitis there was no great dorsal pain, no opisthotonos, and by the same fact, it may have been reflex paraplegia, but the symptoms all tended to congestive...
is a sure indication of a slightly increased activity of the blood vessels in some part of the cord; and in congestion it is frequent. Excessive vascularity, however, tends to anaesthesia, which accordingly masks the others, and the result in most cases is numb sensation or rather a tendency to anaesthesia which depends upon the part affected.

The loss of motor power is usually incomplete but may very rapidly pass into general paralysis. Beginning in the legs or even in the arms it extends, often in a few days, to the rest of the body and the pulmonary muscles. Its quick diffusion constitutes its great danger, added to the circumstance that it affects early the voluntary muscles, as the rectum, bladder etc. The first sign of the attack, moreover, is often sudden. A girl convalescent from interna fever got out of bed for the first time, walked a few paces and dropped down. "A man, whose case I received from a friend, was seyce ped walking home after being cold and wet all day, with all the symptoms of a sudden congestive attack..."
dragged himself home, and passed next morn-
ing with what is unusual in this disease, complete paraplegia. The amount of fluid effused prevents in many instances convulsive movements in the limbs, although they sometimes do exist. It has the effect also of diminishing reflex power.

The causes which affect the involuntary muscles naturally affect also the vasomotor system, and produce ulcerations and bed-sores to a troublesome extent.

The following symptoms are almost pathognomonic for without them we would not be justified in classifying a case under this head, and I do not know that they occur with any other lesion. The power over the limbs is greater when lying down than in the erect posture, and for this very evident reason that the effused fluid exerts its pressure on the lower part of the cord under the latter condition, while in the former it is diffused through the verte.

bral and perhaps the cranial hollows. On rising, however, after a night's rest or from having long been recumbent, the paralysis is
is greater, and the patients constantly tell you that they are worst in the morning. This is also to be accounted for mechanically, by the gravitation of the blood towards the medulla spinalis. It is interesting to know that in some of these patients the decubitus is on the side or belly.

From these remarks it must be evident that congestion without effusion cannot be distinguished from myelitis or meningitis; and it is not astonishing when we remember that this kind of congestion is the first stage of emolissement, induction, and suppuration.

The prognosis is not so bad as the spinal effects already mentioned. In the child indeed it is favourable; and it is so even in the adult under certain circumstances, as when it results from an acute disease of some sort or from a removable nervous obstruction. In other cases, especially when the cause of the lesion is not very apparent, we have hardly better hopes than in myelitis.

The congestion of the membra...
is most marked in the peritoneum, and that principally in the lumbar region. Dilatation of the vertebral veins is a common post-mortem appearance, and as in other dropsies obstructive diseases of the pelvic and thoracic viscera are common. When the effusion is chronic, the serum is yellowish or reddish, while in the acute it is clear though sometimes tinged with blood. One result of congestion is thickening or ossification in the arachnoid. This ossification, according to Rokitansky, is in the form of numerous concave convex scales "towards the periphery of the cylinder" embedded in the arachnoid and projecting rather inward. They are due to repeated attacks, doubtless, of acute congestion and the effusion of liquor sanguinis.

D. Extravasation of blood in the Spinal Canal.

I shall notice hemorrhages here because it is greatly due to excessive vasodilatation.
Vascularity of the cord and its membranes, and I would merely premise that it may also owe its origin to disease of arterial tunics.

The premonitory symptoms are frequently those of slight cerebral congestion with perhaps an uneasy feeling in the spine. But it may come on without these or it may take place in the course of a thoroughly established paraplegia. It comes on suddenly, more suddenly than any other paralytic affection, unless it be in some rare instances the effusive congestion after acute disease. The symptoms vary infinitely according to the seat of the extravasation. Suppose the blood effused in large quantity in the meninges, the mechanical effects of pressure would be mingled with signs of congestion. The case could be diagnosed from effusion only by the sudden bequeath and the absence of those characteristic symptoms to which I already referred. Generally, however, the quantity is not large enough to produce this effect, and it shows itself then by irritating pressure on the part in which
it congealates. Let the blood again be expelled into the substance of the body, and it is nearly always in this case into the grey matter, and we have very different symptoms. In this form the loss of sensation is great without much loss of motion: in that precisely the opposite happens. In this there are referred sensations from nerves involved in the lesion without convolution or very marked motor phenomena; in that convolution are constant, referred sensation nil. In this the sphincters are paralysed; in that only by concession deserted. In both, however, the presence of another lesion modifies the symptoms. In nothing was a considerable number of cases I have been unable to find any in which congestion myelitic or some other cause of effect was not present. Sometimes white softening, retroverted blood (or myelitis in the same subject are to be found, and then the order of causation is that in which I have written them. The prognosis is not good. People recover though not often and there is always great danger of a second retroversion. The effects of a small clot and the possibility of recovery are well
(1) Bronsonia, it is right to remark, distinguishes softening as sometimes progressive, sometimes the result of inflammation, but gives neither p.m. differences, nor the characteristic symptoms. Cours de Pathology I IV p. 142.

In the same way Andrade thought some cases of acute softening might be due to irritation. Path. Anat. p. 748.
shown in a case recorded by Crural
in which an old injured cut was formed
and a new one surrounded by inflammation.
Four years before death she had pain
and hemiplegia (it is no illustrative as if
it had been paraplegia) from which she
gradually recovered. There was pain in the
spine. Olivier and Brown Seepard assert
however, that there is no recorded case of
cured paraplegia from pneumotorachis.

II

Lesions of the cord not characterized
by increased vascularity, rather by
diminished.

A White Softening.

Among the older writers on the sub-
ject there are none who distinguished this
from the other forms of remission.
Bellmann, Bardal, Olivier, Bronsasid re-
garded all as the result of inflammation.
and many of the modern writers assert
that yellow white and red softening have
the same symptoms and etiology. From
these causes and the consequent difficulty
Mary present the now-asserted symptoms, but most have no accurate description of the disease.
in comparing cases as well as from the fact that I have not had an opportunity of meeting with a case, I shall give but shortly the results of the most recent labours on the subject and principally those of Mr. Brown Segard. Its importance is great, as secret to inflammation it is the most common cause of paraplegia or at all events quite equals or that respect the reflex and suggestive.

The symptoms which in the earlier part of the paper might at was stated to present in any form of paraplegia are especially well noticed in this, possibly from the fact that there are none other to interfere with their manifestation or draw attention from them. It is unnecessary to recapitulate and it may just be observed that anaesthesia is perhaps a little longer of manifesting itself than in the inflammatory disease particularly in regard to Common sensation. Anaesthesia however always comes on, and is often very complete. Most of the other means of diagnosis are negative. There is no pain
in the back with or without pressure and percussion. The reflex power remains normal. There are no spasms, convulsions or twitchings, nor are there any referred sensations.

The prognosis is bad as the lesion depends on sclerosis or other degeneration of the arterial tissues.

The name of the affection is taken of course from its appearance. Bothered associates it closely with the yellow variety, but that is more often inflammatory if not always so. He states that all the intervening shades of Colour are to be found. In some cases there seems to be an infiltration of Serum, which has resulted in loosening, separating, and breaking down the structures of the cord; but real invasion from arterial disease is generally the sole and efficient cause of the softening. The whole thickness of the cord may be converted, into a soft pulpy mass protruding when cut, and in which hardly a trace of nerve fibre or cell can be found. The whole pathology of the disease both in brain...
and just as involved with some obscurity. It is to be remembered that myelitis may often coexist.

B. Reflex or Induced Paraplegia.

We shall now consider a disease which, whatever its nature, is certainly not dependent on increased vascularity of the cord and indeed on any very cognizant change in that organ. It is the reflex paraplegia of Graves, Obomberg, Pons-Seguy and others, a name not perhaps very fortunate as implying a theory indubitably correct but not quite universally accepted. Paralysis of the lower extremities has long been observed as a sequel to various acute diseases especially of the abdominal organs; and in the horse it was well known that renal affection might terminate in loss of power over the hind legs. Very often myelitis or congestion was found after death; but in the greater number no change whatever could be detected by the most careful examination in later times even with microscopic.
microscopic mind. They were referred to the
head of spinal irritation or of idiopathic
paraplegia, but of which however, may
safely be excluded from our nomenclature,
even although we may not be able to classify
as yet a large number of cases. The symptoms
however, are tolerably distinct and sufficient
to constitute them a division by themselves.

The begins of a passing em
igration of the cord somewhat resembles
those of reflex paraplegia; but those of
myelitis are essentially distinct. In the
cases which we should have no hesitation
in referring even during life to this division
of our subject, there is more resemblance
to white Softening. The symptoms are to
a large extent negative...

It comes on as a sequel
of some other disease or actual affection
of the body, and progressed rapidly varying
however, with the alterations in the cause,
if that continue to act. And this is the
diagnostic mark, when the other symptoms
have been taken into account. The following
case is typical following as it did in
flaunntion...
Graves Clinical Medicine Vol I p 548.
Inflammation of the intestines and peri
tontities. The lower extremities were quite
useless. The paralysis, however, was confined
to the muscles: there was no diminution of
sensibility in the limbs: no numbness, pain
at formation, and the muscular functions
of the bladder and rectum were apparently
uninjured.

The gradual extension of the paralysis
upwards is very rare but it often becomes
pretty complete. The affection of bladder
and rectum is not common, but the above case
as followed by one, in which, while in other
respects precisely similar, there was slight
paralysis of the contractile powers of those
organs. In both patients, as in most other
the amount of power over the limbs in
the horizontal position was very much
greater than in the erect. The same symp-
toms occur over and over again resulting
from cold, enteric, urinary, prostate and
other affections, and all it is to be observed
gaining better rapidly, although in a few
and some weakness may long remain. It
must not be supposed that sensation
always
always remains normal, indeed it is general by diminished but very rarely to a great extent. Moreover we may have, though rarely, tingling and prickling sensations as in a case by Dr. Stokes, or feelings of coldness and numbness as in echis I's case related by Dr. Carmichael of Dublin, but the feeling of abdominal constriction never occurred and the referred sensations are seldom severe. There may be pain in the spine. The symptoms of motor or ganglionic irritation such as cramps are frequent very different from congestion and above all inflammation, reflex paraplegia is not characterized by any change in the urine, as might be anticipated from the fact that the bladder is rarely attacked. I have gathered these symptoms more from a study of recorded cases than from the writings of authors on the subject, even though in very few the test of the microscopical signification has not been applied, their analogy to those in which it had been used as a fair warrant for referring them to this head.

Let us inquire into the

nature
nature of the malady. While the existence of reflex paraplegia was asserted by many whose opinion carried weight, and was stated by them to be totally distinct in everything from inflammation, their theories by way of explanation were so constantly unsatisfactory that men rejected not only them but the facts on which they depended. Dr. Byle accordingly suggested the term "induced" as less capable of being misunderstood and misapplied than reflex or sympathetic, but the term is unimportant if the attacked idea be correct and it is already too firmly established to be altered. The following is Dr. Jones' explanation. "The impression made by inflammation on the nervous filaments distributed to the coats of the entericase is propagated to the spinal cord and from this reacts on the muscular functions of the lower extremities." This be applies to sensory and other reflex paraplegia." Dr. Stanley states that the "irritation" (certainly a convenient word) is propagated through sensorial nerves to the spinal cord and
"the impressions thence transmitted through both sentient and motor spinal nerves to the limbs there producing pain and paresthesia, ment both of sensation and the power of motion!" Rhomberg so particulars. It is probably, he says, not too bold an hypothesis, if we explain reflex paralysis by assuming the existence of similar nervous centers for the upper and lower extremities, and their connection with centrifugal fibres derived from the various organs. These are anything but extraordinary and explain nothing. The fact remains that in paralysis resulting from abdominal disease and other causes of a like nature there is functional without perceptible structural lesion of the cord. It is hardly necessary to enter into proof of this assertion. It has long, as I before observed, been noticed in the horse and in man as following intestinal disease or irritation. Mr. Harris gives two cases in which it followed severe purgation, in the one from a large dose of croton oil, in the other an immense draught of some nauseous medicament."
given that there is no verible lesion unless it be a bloodless condition of the medulla spinalis.

Dr. Gull in the last volume of Guy's Hospital Reports has endeavoured to refute their arguments by the following counter assertions:

1. That it is on cutting the head of Quadratus muscles pamplygia is produced and not by excitation of the kidney, a fact opposed to urinary not to reflex para-pamplygia.

2. That he has never seen blood vessels contract on tying the sub of a kidney and that it is impossible, from the amount of anastomosis that only one half should do so. But the fact that he has not seen it does not negative Mr. Brown Segard's statement that they did so, and certainly as part of one or any quantity of vessels may contract alone under nervous influence.

3. Dr. Gull asserts, for he opposes the reflex theory altogether, that the symptoms are not those given by Mr. Brown Segard but closely resemble myelitis.
medicine. The same holds good as to the genito-urinary system, so much so that there is a term urinary paraplegia. Even Arnestad has remarked in paralysis resulting from disease of the kidney and gonorrhœa. Cases by Almberg, Graves, Stanley Bant, Looy d'Etistelle, Sevareid, Rawi, and a host of others have been recorded. There is a suppurative paraplegia, a paraplegia from cold, wet, fever, and many things else, without in many cases the least structural lesion. The question then is, what is the nature of the disease? Is it functional is simply a cloak for our ignorance and means merely that we have not discovered the exact physical change? I think this is not so. Is the change then a myelitis, a meningitis, or any of those we have discussed, but in a form difficult to discover? This view is not without support; for there are cases of myelitis in which the microscope alone can detect the fact. But all of these were during life different in their symptoms from reflex paraplegia. What then can we observe as
to the true state of affairs? Brown Seaward has offered an explanation extremely probable as agreeing with all the phenomena already recorded, which is moreover supported by other strong arguments. It is that chronic tense contraction of the blood vessels of the cord is produced through the vasomotor apparatus, a stimulus applied to the periphery of different nerves in the abdomen or elsewhere acts through the nervous centres and the different fibres on the vertebral vessels. This would of course cause renal nutrition. In local anaestheisis by snow and ice we have the contraction of the blood vessels producing such renal nutrition of the extremities of nerve fibres that they cease to perform their function for the time. He has supported his view by the following:

1. The experiments of Cohnheim on once producing paraplegia on section of the Kidney.

2. The fact that on tying the hilus of the Kidney he has seen the vessels of the same side of the Cord contract.

3. The negative statements already...
I can only say that I have taken my statements from cases of Graves and Klonberg and that they agree very perfectly with those of Brown-Séquard. The theory is not proved to demonstration, but it is at present the only one worthy of acceptation.

Our prognosis depends greatly on that of the disease with which the paralysis is associated, the length of time it has lasted, and its manner of attack. Generally it is very favourable, and the paralysis may be expected to disappear within or soon after its exciting cause. Sometimes, however, we know not why, more frequently when cold or such-like has predominate it, it lasts for years and may pass into myelitic or remain for life an incomplete case. Perhaps when the mode of attack is gradual, the case is also slow.

### III. Various Reactions

which cannot be reduced to the others.

It now only remains to say a few words...
on Tumours within the Vertebral canal, or concussion, fracture, and curvature, or myelia, and on the effects of certain poisons which produce paraplegia.

A. Pressure by tumours, altered vertebrae.

Tumours, either of a benign character and when they do not produce inflammation, compress the Cord and give rise to atrophy; when malignant they supplicate, as they do in other parts of the body, the surrounding tissue. In fracture and caries producing curvature, when the irritation does not cause angulitis or meningitis, the result is also due to Compression. Let us then consider these in their relation to pressure, for we have already spoken of inflammation; and I would only observe before proceeding that the pain on pressure or motion is of course greater, and is more constant altogether in inflammation from fracture than from other Causes; and that the diagnosis is founded on the history (and an Examination of the Spine). It is to be observed that fracture.
fracture with considerable displacement need not produce paraplegia. In one case last summer under the care of Dr. Spenne in the infirmary which I had an opportunity of watching, there was not the slightest symptom of the sort. The man had sustained a fall from a horse, and the spine of the tenth dorsal vertebra protruded a good deal.

The symptoms of a paraplegia due to pressure from tumours or otherwise vary according to the part of the compressing body. As that point there is pain in pressure. The parts below have then reflex function somewhat increased as being beaten in proportion to their degree of isolation from the compressing ribs, and this causes twitching and the other results mentioned as due to such a condition.

Hence the tumours press upon the roots of nerves, when clonic or tonic spasms occur also occur, there are no referred sensations. The confinement of motor and sensetional parallel to the distribution of the affected nerves is the special symptom of compression from this cause. As tumours i.e., are usually pretty
pretty high up vesical paralysis is apt to be produced. By a reflex action in the medulla oblongata true epileptic fits may take place.

The most common forms of tumours are the Encephaloid, tubercular, syphilitic, and fibrous; and of course, except perhaps in the syphilitic, the prognosis is very bad.

We may hope for a better termination to fracture, as the paraplegic may be more to concussion than anything else, and may speedily pass away; and there seems to be a certain ability in the cord to adapt itself to its altered situation, as the cord is larger than is necessary merely to contain it. I know of one case, a child, that was paraplegic for two or three years from fracture and recovery. It was seized by acute fever and kept in bed for some weeks. On moving it could walk. It may be that constant motion (the fracture was in the upper dorsal region) prevented complete union. It kept up a chronic disease of the bones and a constant irritation and congestion of the cord, and that healing was not healthy.
B Concussion

In Concussion there is paralysis of motion with anesthesia generally. It is as a rule accompanied by pain, sometimes very intense, in the affected limbs, of which the temperature may be altered. There is considerable pyrexia.

The injury is of course a mechanical one, yet more but the functional lesion is discoverable. Whether it consist in a rupture of nerve fibres, a disturbance or disruption of their central conducting arcs, cylinder, or a shaking up of the contents of the nerve cells or destruction of these last themselves or all of them together has not yet been ascertained. But it is something of the sort as proved by the reiterative instances in which one side of the cord is alone injured. In these cases there is paralysis of one side with anesthesia of the other.

The prognosis is favourable.
The only danger to be guarded against is the occurrence of inflammation as indicated by pain or pressure, twitches, inflammatory fever, and the other signs of acute or chronic myelitis.

C. Hysterical paraplegia

The pseudo-hysteria appears in this shape as it does in that of any other disease. Its symptoms resemble as a whole those of reflex paraplegia, and as a result of sensory systemic irritation it may very properly be so classed. But the cause must be borne in mind as the treatment for hysteria is to be employed. To show how difficult the diagnosis may be in the first instance I need only say that pain in the back, referred sensations, twitchings, convulsions, constriction of the trunk, loss of power, and sensation (the latter, however seldom), and difficult respiration may each and all be observed in hysterical paraplegia. But the pain in the back seems confined to the skin, and as to the paralysis
Sir Benjamin Brodie. Lectures on Localchronous
D. There are certain herbs which also produce this form of disease. The Lathyrus sativa, L. accors, and Ervum Ervilia have all been noticed as giving rise to it. Dr. Jones states that a kind of paraplegia is very common near Allahabad, in which, while slight aches were felt over the forearms and limbs, no symptoms but loss of power could be discovered; and on inquiry it did not seem to shorten life. It was universally attributed by the natives to khesaree dāl (L. sativa), which is sometimes used as food, but in many cases it appears to be immediately induced by exposure to cold and wet. D. Kennedy mentions the Ervum Ervilia as rendering horses paralytic and when in brood producing weakness of the legs in mares. Both and the Lathyrus are both referred to by D. Taylot as poisonous in food and the latter is expressly forbidden on some parts of the Continent. Lead
Palsy and that from arsenic very rarely are paraplegic and are easily diagnosed.

I would merely refer to what can hardly be called a paraplegia as it generally affects one limb only, that, namely, which arises from pressure on the nerves going to the legs. It is very rarely seen. The pain in the limbs is very severe resembling that from pressing the ulnar nerve, while there are no symptoms of spinal affection. Its exciting cause, moreover, is the gravid uterus which presses on the sacral nerves, but which it must be remembered may in some constitutions and under unknown conditions give rise to a reflex paraplegia.

Means of Diagnosing the Locality of Spinal Lesions

To this we would give a few moments direct
direct attention; but thoroughly to understand
it we must know also the physiology of
the Cord and the nerve roots. I shall inter-
rupt no arguments on that subject; but
I shall state what appears to me tolerably
well ascertained, and endeavour to show the
assistance its diagnosis to be thus obtained.

1. The posterior nerve roots are
composed of Centripetal, the anterior entirely
of motor nerves.

2. A portion of the posterior root
of each nerve is destined for reflex action
and terminates in the nerve cells of the
anterior of the Cord. The remaining fibres
are for sensation and pass upwards prince-
apally in the posterior part of the gray
matter, though some occupy the anterior
gray and even a very few the white half
of the medulla spinalis. After reaching the
Cord the filaments of this root take their
directions to reach the interior. Some go
straight upwards, others pass upwards for
a short distance in the posterior (or lateral
white columns, while others again do the
same in a downward course. The gray
matter.
(1) The expression is perhaps not strictly correct but it makes to understand.

(2) Sir C. Bell in the nervous system p. 429 shows that lead poisoning is in affection always of muscles having a combined action.
matter is thus the principal channel for sensational influences. There is however the greatest difference of opinion as to whether the posterior columns are channels of sensation. Brown-Séquard says not at all. Van der Holte says almost the only ones.

3. To the posterior roots the orders of the will are conveyed downwards by the gray matter, and the anterior and lateral white columns. Osganallow, and more recently his observations have been confirmed by Van der Holte showed by anatomical facts and other arguments that in all probability the filaments in these parts of the cord rived in nerve cells whence the anterior roots were derived.

Van der Holte has gone far to prove that the spinal cord may be regarded, so far as it is a reflex center, as divided into segments or ganglia in the same manner as in some of the lower animals. Ganglia exist receiving like Leyden jars their charges from the will or the periphery, and discharging by the posterior roots.
5. Motor fibres decussate in the medulla oblongata: sensitive throughout the cord.

In addition to these facts the effects of pathological states must be taken into account. In some parts of the back, nerve fibres are excitable in their course; that is, the application of stimuli causes sensations referred to their distribution. In other parts they are not so, as in the cord. Now sinu-illumination and local congestion heighten this faculty if it do exist, call it into operation if it do not. Let us see what can be deduced from these facts.

Sensation it is evident will be diminished under any of these conditions, a destruction of the posterior nerve roots, of the posterior and posterior-lateral white columns, in a large portion of their extent (a small portion is not sufficient from the short distance that sensational fibres traverse them) and lastly a destruction of the gray matter for the fibres are the other columns are too few to be taken into account. The amount of destruction corresponds of course to the de-
Pressure on the ventral canal produces various degrees of anaesthesia by action on the grey matter, if on the meninges by action on the nervi roots.
degree of anaesthesia. Now if we find the symptoms of a myelitis and among them complete anaesthesia we should conclude that paralysism or some other of its results had taken place in one of the parts already mentioned, and we should be justified in suspecting the gray matter to be involved, as it is almost unprecedented that the roots and nerve that so large an extent of the posterior column is involved while the gray substance remains healthy. If again it be pleuritic or with complete anaesthesia, the blood has probably been extravasated in the gray portion of the cord so that is the usual locality in which it occurs when it is not meningitic. With signs of a tumour it is evident that the growth must exist in the central part or if outside must be unusually long. And as of all the other paralysis Complete loss of sensation, however, is extremely rare and can only occur in these lesions. The extensive distribution of sensory filaments throughout the cord prevents this condition. A diminished amount of sensitivity is as we have seen the general rule.
5. Motor fibres descanseto in the medulla oblongata: Sensitive throughout the cord.

In addition to these facts, the effects of pathological states must be taken into account. In some parts of the body, nerve fibres are susceptible to their course; that is, the application of stimuli causes sensations referred to their distribution. In other parts, they are not so, as in the cord. Now in inflammation and local compression heightens this faculty if it do exist; call it into operation if it do not. Let us see what can be deduced from these facts.

Sensation it is evident will be diminished under any of these conditions, a destruction of the posterior nerve roots, of the posterior and posterolateral white columns in a large portion of their extent (a small portion is not sufficient from the short distance that sensory fibres traverse them), and lastly a destruction of the gray matter, for the fibres in the other columns are too few to be taken into account. The amount of destruction corresponds of course to the de-
rule, and may be referred to any of the above parts; the gray matter in almost all cases the most likely, nearly certain when there is much anesthesia. In some cases, however, there may be no loss of sensation may even hyperesthesia, while the channels for sensory conduction are extensively altered; and we cannot, therefore, safely conclude that normal sensation proves the integrity of the parts we are suspecting. This is to be accounted for as follows. An irritation of the posterior white columns with the gray matter healthy, tends to produce marked hyperesthesia, and so gives a means of diagnosing the lesion. But, moreover, even when a considerable part of the gray matter has been destroyed, the hyperesthesia may mask the anesthesia that would otherwise be sufficiently apparent, and a normal sensibility would be the result, for it would seem that the filaments from the different parts of limbs are thoroughly intermingled in the cord, so that one part does not retain sensation while another loses it. There are cases recorded in which a whole zone of the white Columns and some portion of
of the gray matter have been destroyed with
cess producing anaesthesia, in result partly
due to the fact that the majority of sense
fibres pass up in the centre of the Cord, part
ly to this masking of the loss in one set
by the excess from the other. When with a
complete paralysis of motion the sensibility
is normal we are justified in supposing an
alteration of the kind we have referred to.

In complete loss of motor power
one of the following lesions must have occurred;
destruction of anterior nerve roots, or of
gray matter extensively or in combination
with the anterior and interspinous lateral white
Columns; and in these again the destruction
corresponds to the loss of power. It is rarely
complete if the nerve roots be affected; but if
the symptoms be those of menyngeal or con-
cerection, we suppose it due to the roots. In
the gray matter the destruction must be
considerable before the paralysis becomes com-
plete; but a mere zone is sufficient for
the purpose of at the same time the motor-
white Columns be the situation of disease.
When we diagnose a myelitis or haematomyelitis
These vary according to the nature of the lesion; but the same cause may, under different circumstances produce different effects. Our knowledge is very imperfect; but I shall refer to a few observed facts. These are, then—

A. A set of causes which operate by irritatig the extremities of centripetal nerve fibres. Of these are—Cold and wet, which often give rise to paraplegia in three or four of its different forms according to the degree and length of exposure. They may cause a contraction of the blood vessels of the cord, which remains after the cessation and may thus excite reflex paraplegia. Cases of this kind are referred to by Graves, Watson, Moore and Brown-Sequard. Or again exposure may cause, what is equally a reflex paraplegia were the name not already applied—a congestion of the cord, perhaps by the exhaustion of its contractility in the vascular muscular fibre under the force of the stimulus. And this congestion may in the first or by many
of such like this is our method of accounting for great loss of motor power.

As might be supposed from the decussation points of the fibres and the effect of a lesion in the posterior columns, the destruction of a lateral half of the cord produces paralysis of the same side with hyperaesthesia and anaesthesia without loss of power in the opposite.

These facts are all borne out by cases in which post mortem examinations have been made.

The means of discovering in what part of the length of the cord disease is seated are to be found principally in a knowledge of the anatomical distribution of the nerves. The origin of those which are distributed to the paralyzed parts must necessarily be at or below the seat of the disease. How much of the cord upwards and downwards is destroyed we can tell by the extent to which reflex power is concerned. To take an example. There may be paralysis of the lower limbs from an affection of the whole lumbar belt; and
then the whole reflex power is taken away also, for the meeting point of different and different nerves is no longer equal to its function. Or again there may be paraplegia from disease in the lower dorsal region, just above the bulb, when, especially if it be myelitis, reflex action is increased; for it is certain that, the greater the isolation of a healthy portion of the Cord, the greater is the reflex action of which it is the centre. Higher than the legs it is of course difficult to apply this test; but I have already mentioned the application of cold or heat to the spine as likely to be useful in myelitis.

Etiology of Paraplegia

We shall consider this part of the subject under two heads, the exciting and predisposing causes of the spinal lesions we have described.

I Exciting Causes.
many subsequent attacks pass into myelitis
or meningitis.

Other irritations of the skin produce
the same effects. Groves gives a case of Syr-
cupeas. So irritations of the mucous mem-
brane produce the disease; and it is more
than likely that the diphtheritic paralysis
operates in a similar manner, although
Pirouault (de la paralysie diphtherique)
maintains, and doubtless in many instances
with justice, that in the anaemic condition,
the frequent paralytic effects of the soft
palate, uvula, articulation & there is evi-
dence of a general nervous produced by
some blood poison. Irritation of the mucous
membranes of the intestines by worms or
in enteritis is among the most frequent
causes of reflex paraplegia. Innumerable
Cases are cited by Brown Seaward of this
acting as an exciting cause, as well as of
affects of other abdominal organs,
among which may be reckoned, as most
common those of the Kidney, bladder, pros-
state, urethra, and uterus. The ulcerations
of enteric fever, however, perhaps as fre-
quently
(1) Brown Séguard, Paraplegia p. 18.
 Frequently incite congestion as any other spinal disease, and the same may be said of the bowels, while both sometimes produce myelitis. Diseases of the thoracic organs more rarely result in paraplegia; but instances are not wanting of such a complication in diseases of the lungs and pleurae. In children, setting produces now and then paraplegia of the congestive kind; but it is doubtful how far we are justified in arranging it under this head. Neuralgia and disease of the knee joints are mentioned as causes.

B Causes operating through the Circulatory System.

I have already referred to the effects of certain poisons, and to the probable blood poisoning in diphtheritis. The deterioration of the blood, is doubtless, also in operation in fevers and some other diseases which occasionally give rise to paraplegia; but it is certainly the intercostal irritation which is effective in typhoid.
Atheroma and analogous diseases of the nutritive apparatus are the great causes of non-inflammatory softening. Obstructive diseases of abdominal and thoracic organs give rise occasionally to venous congestion with effusion.

Congestion is also a result of the suppression of any habitual flux, as the catamenia, haemorrhoids, &c. I know not whether to include spermatorrhoea under this head or the former. It not only gives rise to reflex paraplegia but, according to Rühmkörrig, as often to white softening.

C. Local Causes.

Causes which act locally are very numerous and give rise to inflammatory and even other forms of paraplegia. Caries of the vertebral column is a common cause of meningitis; and fractures and dislocations of these bones produce the same affection as well as myelitis. Congestion, and even simply atrophy or absorption from pressure. Concrecions may occasion all but the last. Inflammation
(") *Course de Pathologie*, vol. IV, p. 168.
Inflammation of the kidney, besides acting through the nervous system, may pass by contiguity of tissue along a nerve to the Spinal Cord. Injuries not only give rise to their own symptoms and to form a distinct class, but also very often excite congestion, sometimes myelitis.

Acrophalangy and other foreign bodies are mentioned by Bronn as exerting inflammation of the cord.

The exhaustion of nervous power produced by forced marches and such like may be reckoned as partly a local cause; at all events it is certain that many soldiers are laid up after such undertakings.

II Predisposing Causes.

A. Age.

Paraplegia as a whole is confined particularly to no age; but the various times of life have a very different proclivity to certain forms of the disease. Perhaps in childhood it is more rare than in adult life.
life, though quite as common as, if not more so than, other paralytic affections. The period of detention is most liable to paraplegia. Dr. West has given a table to show this and other paralyses occurring between birth and four years of age bear the proportion of 3 to 1 at any other time under eight. The reflex and congestive are the most frequent in the young; but it may be congenital from malformation, and Olivier gives the case already quoted of Auguste Mettral at two months, who had acute uncomplicated myelitis. The case has been related to me which could hardly be other than hermatorches. A child previously in perfect health, suddenly while playing dropped down paraplegic. I have seen the child since its recovery, and curiously enough it has varics in both feet, a consequence of the disease. Such being the case it is somewhat puzzling to classify the whole under the head of infantile paralyses; even although the diagnosis of the particular disease may be somewhat difficult. Between the years of thirty and fifty so said to be the term
These statistics taken from hospital practice are curious when viewed in relation to the Returns of the Registrar Gener-
al which show a precisely similar number of males and females in proportion to the total number of the In-

10
at which tabes dorsalis or rather softening takes place, and it is undoubtedly the case with reference to the non-inflammatory. The exciting causes of myelitis, however, are so powerful and so evenly distributed through life after puberty that any tendency of this sort which may exist is considerably modified. Other forms of paraplegia cannot well be referred to any particular age.

B. Sex.

There is a most remarkable difference between the sexes and one not easy to be accounted for. According to Abernethy the proportion of male to female patients is as 8 to 1 in cases of softening, but it is probably exaggerated, as the tables of Dr. Brown-Squard show, so in other paraplegia (except hysterical) that the males are about 4 to 1 female. It may arise from the greater exposure of the male sex to the causes of the disease; but this does not I think explain so great a discrepancy.
C. Paralysis

Analysis of the lower extremities seems sometimes to assume an hereditary form, and to attack members of the same family, whether from some peculiarity of constitution common to them or from their being subject to the same causes it is difficult to say in the majority of cases. I have heard of two. One, a lady whose disease made a noise in the medical world, as it was attributed most absurdly to chloroform, had a brother and uncle in the same condition. The other, belonging to a family, in which nervous diseases were ripe, had four or five relatives afflicted with paraplegia.

D. The habits and mode of life will of course have a great effect in predisposing to this disease. Vicious habits in youth, excesses of all sorts, which tend to exhaust and injure the nervous system, are very powerful in their effects. Paraplegia is particularly liable to appear in those who have, as it is said, seen a great.
great deal of life.

E. It is right to remark that many things, already noticed as exciting causes, may also act as predisposing. While true fever by the blood, poison may itself give rise to paraplegia in predisposed habits; but will without doubt to make the action of a cause of congestion or myelitis more sure. We find that cases of this kind are given by all authors, and especially by Oliver, are extremely common as a sequence of acute disease. And it is not to be wondered at, for the vital powers still in their exhausted state are being taxed to the utmost to repair the ills. A little more can they go wrong.

Treatment.

Now come now to the cause and end of all medical investigations, and we shall find that recent discoveries in the physiology and pathology of the nervous centres have been...
been productive of the best results. I shall merely mention what, according to our knowledge now, are the best and most approved plans of treatment.

Paraplegia is to be treated in reference to the two great classes under which we have discussed it. In the inflammatory state our object is to reduce the amount of fluid in the cord, and to remedy, if possible, the mischief already produced; in the non-vascular condition to increase the quantity of nutritive fluid when the atrophy or other consequences of the disease will be remedied. Formerly Strychnine was supposed to be the drug for all forms of paralysis, our idea probably entertained on account of its decided power of increasing the vital action of the cord as a centre for reflex action. The tendency now, as in all other reactions, is to deny its efficiency altogether, and many maintain that no substance has it ever been known to do good. The proper course is probably intermediate, though it is certainly less often successful than otherwise. I have seen it used in
Some cases, inflammatory and not so, without the slightest benefit; in one, if not indeed in two, with the most decided injury. In one case, however, of hemiplegia (probably from white softening of the brain) I have seen increased power in the arm and leg follow its administration, though without permanent advantage. In the Lancet of 22nd March 1862 there is a notice of administration, with concurrent improvement to a marked extent, of 1/30 of a grain of strychnia three daily with several grains of sulphate of quin. The case was one of fractured vertebral with at first complete paraplegia, and of the return of motor power is to be ascribed to the strychnia and not to coincidence or other means, it is certainly very remarkable.

I Treatment of Inflammatory Rheums

In these strychnine is most certainly to be avoided, for by the experiments of Van der Rolk and others its most manifest effect is to produce an increased flow of blood.
blood through the cord, forcible enough in some cases to result in slight extravasations. Van der Noot states that in two dogs which he poisoned by strychnine, the gray matter of the lumbar bulb was highly congested, and in one small effusions of blood had taken place from over dilatation of the capillaries. We must look for remedies that diminish the amount of blood, and in ergot of rye and belladonna we find two most important medicines, both acting by contraction of the vessels. They have been generally used without any exact knowledge of their powers and merely from the general nervous symptoms they produce. The most contradictory statements have accordingly been made as to their therapeutical value. Dr. Wood says "ergot has recently been employed with supposed efficiency in paraplegia after the cessation of all excitement of inflammation in the spinal column, supposing the affection to have originated in this condition. Religan says of belladonna that it was at one time generally stated by writers that it must not
not be used in acute inflammation; but that it is now known this does not contr­
indicate its use. And this opinion is certainly correct. They are both depressors
of the circulation and to be used precisely in the inflammatory forms of paralysis.
Half a grain of the Extract of Belladonna may be given three daily, or seven grains
of Ergot, or perhaps still better, what I have been used with advantage gradually (and
up to the present time), three grains of Ergot with a quarter grain of Belladonna made
into pile. The medicines require, as one might expect, a considerable time to pro-
duce an effect.

Stramonium may be tried, but the experiments as yet are not sufficiently
numerous to allow of any decided opinion as to its efficacy.

Hyoscyamus and Indian Hemp are often useful, not only in diminishing
the amount of blood in the cord, but also by producing sleep in cases where
incompliance is a symptom. Opinion from its known properties is strongly
mischievous.
madamable for this purpose. Mercury is a remedy that has of course been applied to this as to almost every other disease, and not, it is said, without effect. From its proved action in preventing and reme
ding poisons and perhaps other inflam-
mations in certain parts of the body, it may have a Curative effect in some forms of paralysis. I have seen it pushed to slight salivation in two cases of myelitis without benefit if not with injury.

Iodide of Potassium, which in modern practice seems to have taken the place Mercury held with older physicians, and which is at all events safer, has been used purely empirically in inflammatory as well as all other forms of paralysis, and according to Mr. Brown Seignard and others who have had much experience, with the greatest success. One would be inclined certainly to try its absolving effects in case of tumor or hematochus of some standing, and without doubt, as strongly is it recommended, it ought to have a fair trial in other affections perhaps in conjunction with
with Ergot and Belladonna. In congestions with effusion of serum, no remedy is so rapid as nearly as successful as the iodide of potassium.

Drurries may be given in some cases of hyperaemia of the cord, and they will probably be found most useful in cases of obstructive congestion, as they are so many desiries elsewhere.

Attention must be paid to the general health of the patient, and a nutritious diet with a moderate assiduous use of stimulants will often do great good of itself.

There are various local measures which may be resorted to with some hope of success. The more powerful counter irritants must be used, if at all, with caution; for there is as we have seen a great tendency to the formation of blagues. In the early stages, however, they may very properly be applied, and the milder forms as blisters and aspirate are useful especially in meningitis. The cold shower bath and alternate cold and heat to the spine have been recommended.
Belladonna plasters are a good adjuvant to the internal administration of that drug. The position of the patient in bed is, according to Brown Sequard, of prime importance. That by the effect of insufflation and otherwise the blood may be diminished in amount in the cord, he directs the patients never to lie on the back, but to keep the limbs dependent and warm. I have already referred to a case by Bloch in which the natural cure took place on the side of the belly.

II. Treatment of non-inflammatory disease of the cord.

Treatment in reflex paralysis is of course to be directed in the first instance to the removal of the exciting causes whether voluntary, arterial or otherwise; and it is wonderful how frequently the paralysis disappears with or shortly after the disease that produced it. By the use of narcotics locally or such substances as are likely to interfere with reflex action we endeavored...
To prevent the operation of the disease upon the Cord whilst we are engaged in its cure. Infections suppositories and such like of opium, Belladonna, Hyoscyanum, &c. are the means employed according to the situation. At the same time we use other remedies directed to the affection of the Spinal marrow.

Strophanthus is evidently a remedy for diseases of the Cord in which the amount of blood is diminished, and it has been employed with great advantage in cases of reflex paraplegia. In all the medical papers, repeated instances are mentioned, which prove it to be a most reliable drug in this respect. It acts by increasing the amount of blood and by a specific action on the tissue of the Cord increasing also the reflex power. This last as proved by the fact that direct application produces even tetanic spasms. For the former purpose it may be united with opium which has the same effect and is often useful as a narcotic. The dose is about 1/120 thine daily to be continued on Causing Spasm.
Spasm. In white softening it must be used with caution, especially if there be evidence of diseased arterial coats, as it is then apt to produce retraction. For this the trichloride of potassa is recommended, but our main reliance must, I think, be placed on good diet, cod liver oil, and improvement of the blood by iron or gum, the former in preference to the latter. Sub-phosphorus is used for both forms of paraplegia. Internally and as a bath, it is approved of by Graves and Biron Segard. Phosphorus is employed in Germany.

Of local measures there are several. Great benefit is sometimes derived from causing the patient to lie on his back with the limbs raised, and the result of a night to rest in this position may be a temporary increase of power in the morning. Various means are used to cause contraction of the blood-vessels in the reflex paralyzers to such an extent that relaxation from exhaustion may follow. Insertion of water in the form of douche is employed, or, if that cannot be borne, it may be tried...
tried extremely hot, or the one may be made rapidly to alternate with the other. Counter-irritation has not been successful in accomplishing that object when applied to the spine; but it seems to have been beneficial in the shape of mustard or plasters to the thighs or calf. This last is strongly recommended by Grasco, and Illiss, who knew nothing of the disease, gives a case which from the symptoms must have been one of induced paralysis following fever and in which this treatment singularly hastened convalescence.

There are various other remedies which have been tried, but the success of which has been so equivocal that I have thought it unnecessary to say much about them. Of these are Cantharides, Copper, Arsenic, Phosphorus, the preparations of zinc and such like. For the last of these, however, a stronger case may be made out than for most of the others. Its good effect in Epilepsy are often so marked, that it appears probable it may also be successful lower down in the Cord as in a similar
Similar affection; and I have already men
tioned one case with a fortunate result in
which it was one of the drugs employed.

Such are the remedies directed
to the cure of the disease.

There are others of which some
mention must be made before concluding.
whose object is to relieve the results and
do delay the progress to a fatal issue.

The utmost care must be
taken to prevent the formation of bed-sores.
In some kinds of the malady they are, as we have seen, much more apt to form
than in others; and in these by frequently
changing the points of pressure, by the
use of the water bed if possible, and by
the most scrupulous attention to cleanliness
we may hope to prevent them long. This
last point, when the paralysis has ex-
tended to the bladder and rectum is of
the most vital importance. If they threaten
to form speedily a plaster should be
applied. After their formation various ap-
plications have been recommended to
promote cicatrization. All the appliances
for
for other ulcers must be used according to the character of the sore. Collodion has been vaunted as having a specific effect; but to say the least of it, it is doubtful. Brown Seaward has proposed, as likely to stimulate the vaso-motor system which is at fault, the use of ice in a bladder for ten minutes to be followed by a warm poultice for an hour or two. This is found to be also extremely useful in preventing them.

We must endeavour to prevent also the atrophy and general malnutrition of the paralysed parts, and for this purpose Galvanism is often beneficial in stimulating the faulty capillary action. The patient may indulge nightly in a foot bath cold or hot as suits his fancy or individual peculiarities, and in the free use of coarse towels, the flesh brush or shampooing.

In the atuberculosis of the urine and consequent irritation of the bladder which is almost perfectly characteristic of dysuria, appropriate diuretics must be used to correct the tendency.
other irritations of the bladder, will doubtless do good; but Jutapentine and Copaiba are also employed. The Catheter must of course be introduced when required.

Such is the treatment which appears, according to our present knowledge, yet very imperfect, most suitable for the different kinds of paraplegia; but, doubtless, as we become more thoroughly acquainted with nervous function, it will require very considerable modification.

John Clineau